



## Memorandum

Date: May 14, 2008

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### **OPINIONS REGARDING PERIMETER LANDFILL GAS MIGRATION MONITORING SYSTEM SUNSHINE CANYON LANDFILL, LOS ANGELES, CALIFORNIA**

GeoLogic Associates (GLA) has reviewed boring logs and probe construction summaries for perimeter gas migration monitoring system probes installed at the Sunshine Canyon Landfill in Los Angeles, California to evaluate whether the existing system complies with Title 27 CCR standards. The perimeter gas probes are intended to be constructed in the most permeable materials and to extend to the elevation of regional groundwater or the adjacent refuse fill cell, whichever is less. Probes are expected to extend below perched groundwater zones. Table 1 presents the ground surface elevation at each probe as well as: the elevations of various probe zones, the lithologic materials encountered at each depth (based on the boring or probe logs), the elevation of the adjacent waste cell, and the depth to groundwater (if encountered).

Bedrock below the landfill is generally characterized as the Towsley Formation which consists generally of interbedded siltstones, sandstones, and conglomerates which range from poorly to well-cemented. Because the area is seismically active, rocks have been folded and faulted into a complex structure that is highly fractured, contains complex folding and discontinuities in bedding. In some areas individual beds can only be traced laterally for a few hundred feet. As a result, GLA believes that fracture systems are the primary mode of transport for gas and groundwater and that, on a scale of tens or hundreds of feet, vapor and groundwater flow through fractures will approximate flow through a porous media. As a result, we believe that gas probe depths based on a systematic spacing are likely to be as effective as probes located on the basis of specific, targeted beds (i.e. targeting sandstone rather than siltstone). As a result, it is concluded that the approximately uniform vertical distribution of probes at each well location is appropriate. In addition, given that fracture flow is the dominant mode of travel for gas and the entire site is underlain by the same rock formation, the lateral or plan-view locations of the probes are also considered appropriate.

With regard to the maximum individual probe depths, it is noted that a number of the probes do not extend to the depth of the adjacent waste prism. In most cases this is the result of the fact that groundwater was encountered before waste depths were achieved.

In order to evaluate whether the groundwater that was encountered is likely to represent regional groundwater, the groundwater elevations encountered along the north and south ridgelines were plotted against distance from the eastern limit of the landfill (Figures 2 and 3). These figures also include data from on-site groundwater monitoring wells where that data is available. As is indicated on Figures 2 and 3, reported groundwater elevations are shown to increase in a nearly uniform manner as higher and higher ground surface elevations are achieved. Because a much more variable pattern of groundwater elevation would be expected from compilation of numerous perched-water zones, this relatively uniform gradient suggests that the groundwater zones encountered approximate regional water conditions. This interpretation is substantiated by the fact that on-site groundwater monitoring wells exhibit similar groundwater elevation trends. As a result, it is concluded that most of the on-site probes extend approximately to groundwater.

Probes that do not extend to the base of the landfill and did not encounter groundwater include: P-201, P-202, P-203, and P-205 through P-212 (a total of 11 probes). Of these, it is noted that probes P-201, P-202, P-211 and P-212 will be replaced with appropriately positioned probes as a part of the proposed site development. In addition, it is noted that probes P-203, P-205, P-206, P-207, P-208 and P-210 plot near or below the projected line of groundwater elevation and, as a result, are likely to have penetrated to very near the groundwater surface. Only existing probe P-209 appears to have been placed dramatically above the inferred elevation of local groundwater and it will be replaced with two probes of appropriate depths in order to meet the 1,000 feet spacing requirement.

**TABLE 1**  
**SUNSHINE CANYON LANDFILL**  
**PERIMETER LANDFILL GAS MIGRATION MONITORING SYSTEM**  
**REGULATORY COMPLIANCE DETERMINATION**

Monitoring Station	Ground Elevation	Probe Elevation	Zone	Lithology	Elevation of Bottom of Adjacent Waste Cell	Groundwater Elevation
P-201*	1646	1636 1621 1607	A B C	Siltstone & Sandstone Siltstone Siltstone	1600	Unknown
P-202*	1850	1840 1825 1810	A B C	Siltstone Siltstone Siltstone	1600	Unknown
P-203	1873	1863 1848 1833	A B C	Silty Sandstone Silty Sandstone Silty Sandstone	1600	Unknown
P-204	1918	1908 1893 1879	A B C	Siltstone Siltstone Siltstone	1600	1877
P-205	1869	1859 1844 1829	A B C	Siltstone Siltstone Siltstone	1600	Unknown
P-206	1886	1876 1861 1846	A B C	Siltstone Siltstone Siltstone	1600	Unknown
P-207	1891	1881 1866 1851	A B C	Siltstone Siltstone Siltstone	1600	Unknown
P-208	1885	1875 1860 1845	A B C	Siltstone Siltstone Siltstone	1600	Unknown
P-209	2050	2040 2025 2011	A B C	Siltstone Siltstone Siltstone	1600	Unknown
P-210	1831	1821 1806 1792	A B C	Siltstone Siltstone Siltstone	1600	Unknown
P-211*	1713	1703 1688 1674	A B C	Silty Sandstone Siltstone Siltstone	1600	Unknown
P-212*	1596	1586 1571 1558	A B C	Siltstone Siltstone Sandy Siltstone	1500	Unknown

Note: \* denotes probes that will be replaced as a result of landfill expansion.

**TABLE 1 (CONT'D)**  
**SUNSHINE CANYON LANDFILL**  
**PERIMETER LANDFILL GAS MIGRATION MONITORING SYSTEM**  
**REGULATORY COMPLIANCE DETERMINATION**

Monitoring Station	Ground Elevation	Probe Elevation	Zone	Lithology	Elevation of Bottom of Adjacent Waste Cell	Groundwater Elevation
P-213	1642	1627	A	Siltstone	1500	1558
		1612	B	Siltstone		
		1597	C	Sandstone & Siltstone		
		1582	D	Sandstone & Siltstone		
		1562	E	Sandstone & Siltstone		
P-214	1586	1572	A	Sandstone & Siltstone	1450	1534
		1557	B	Sandstone		
		1537	C	Sandstone & Siltstone		
P-215	1587	1572	A	Sandstone	1450	1502
		1557	B	Sandstone		
		1539	C	Siltstone		
		1522	D	Sandstone		
		1505	E	Sandstone		
P-216	1554	1539	A	Sandstone	1400	1438
		1525	B	Sandstone		
		1492	C	Siltstone		
		1467	D	Sandstone		
		1444	E	Sandstone & Siltstone		
P-217	1361	1351	A	Sandstone	1400	1349
		1339	B	Siltstone		
P-218*	1357	1350	A	Sandstone	1400	1349
P-219	1612	1597	A	Sandstone	1400	1389
		1547	B	Siltstone & Sandstone		
		1497	C	Siltstone & Sandstone		
		1447	D	Sandstone		
		1395	E	Sandstone & Siltstone		
P-220a	1765	1750	A	Sandstone	1400	1602
		1725	B	Sandstone		
		1696	C	Sandstone		
		1670	D	Sandstone		
		1643	E	Siltstone & Sandstone		
P220b	1721	1706	A	Sandstone	1400	1594
		1683	B	Sandstone		
		1658	C	Conglomerate & Sandstone		
		1634	D	Conglomerate		
		1610	E	Siltstone		

**TABLE 1 (CONT'D)**  
**SUNSHINE CANYON LANDFILL**  
**PERIMETER LANDFILL GAS MIGRATION MONITORING SYSTEM**  
**REGULATORY COMPLIANCE DETERMINATION**

Monitoring Station	Ground Elevation	Probe Elevation	Zone	Lithology	Elevation of Bottom of Adjacent Waste Cell	Groundwater Elevation
P221	1707	1692	A	Sandstone	1400	1516
		1652	B	Siltstone & Sandstone		
		1607	C	Siltstone & Sandstone		
		1565	D	Siltstone		
		1522	E	Siltstone & Sandstone		
P-222	1719	1704	A	Siltstone & Sandstone	1400	1536
		1664	B	Sandstone & Siltstone		
		1622	C	Sandstone		
		1579	D	Siltstone		
		1539	E	Sandstone		
P-223	1794	1779	A	Siltstone	1450	1680
		1754	B	Siltstone		
		1730	C	Siltstone		
		1707	D	Siltstone		
		1682	E	Siltstone		
P-224	1924	1911	A	Siltstone & Sandstone	1450	1687
		1854	B	Sandstone & Conglomerate		
		1801	C	Sandstone & Conglomerate		
		1744	D	Sandstone & Conglomerate		
		1689	E	Conglomerate		
P-225	1943	1929	A	Siltstone & Sandstone	1450	1692
		1870	B	Silty Sandstone		
		1811	C	Sandstone		
		1753	D	Conglomerate & Sandstone		
		1695	E	Conglomerate		
P-226	1933	1919	A	Sandstone	1450	1716
		1868	B	Sandstone		
		1818	C	Sandstone & Conglomerate		
		1768	D	Sandstone & Conglomerate		
		1725	E	Conglomerate		
P-227	2000	1985	A	Conglomerate	1450	1826
		1947	B	Siltstone & Sandstone		
		1907	C	Sandstone		
		1867	D	Conglomerate		
		1829	E	Siltstone & Sandstone		
P-228	2026	2012	A	Sandstone	1500	1814
		1973	B	Sandstone & Conglomerate		
		1931	C	Sandstone		
		1893	D	Sandstone		
		1854	E	Sandstone		

**TABLE 1 (CONT'D)**  
**SUNSHINE CANYON LANDFILL**  
**PERIMETER LANDFILL GAS MIGRATION MONITORING SYSTEM**  
**REGULATORY COMPLIANCE DETERMINATION**

Monitoring Station	Ground Elevation	Probe Elevation	Zone	Lithology	Elevation of Bottom of Adjacent Waste Cell	Groundwater Elevation
P-229	1958	1943	A	Siltstone	1500	1800
		1908	B	Sandstone		
		1873	C	Sandstone		
		1843	D	Sandstone		
		1802	E	Sandstone		
P-230*	1705	1690	A	Sandstone & Siltstone	1500	1689
P231*	1741	1728	A	Silty Sandstone	1500	1669
		1715	B	Siltstone		
		1702	C	Siltstone		
		1690	D	Silty Sandstone		
		1675	E	Siltstone		

Note: \* denotes probes that will be replaced as a result of landfill expansion.







FIGURE 2  
SUNSHINE CANYON LANDFILL  
PERIMETER LANDFILL GAS MONITORING PROBES  
DISTANCE-ELEVATION  
SOUTH RIDGE

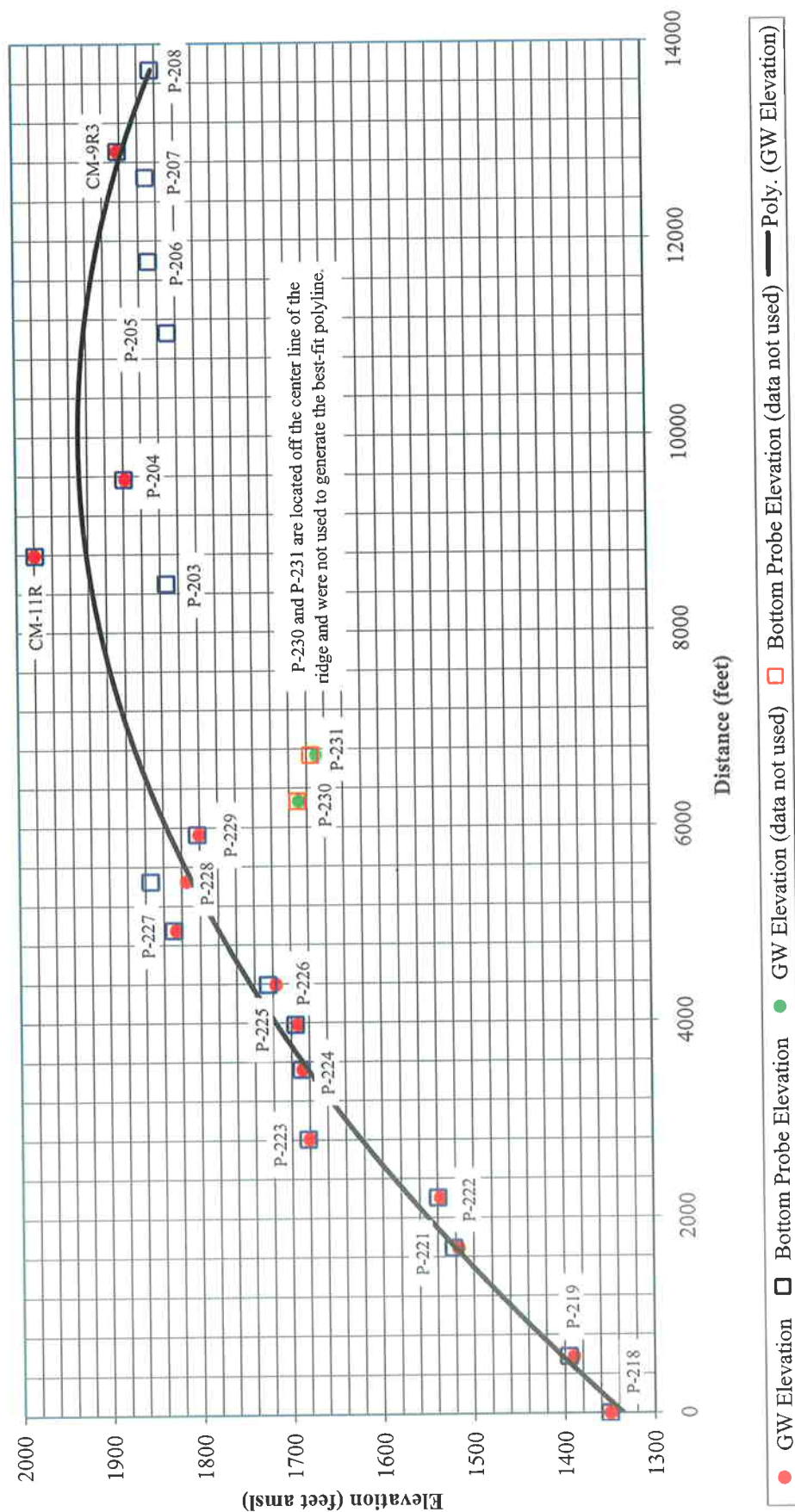




FIGURE 3  
SUNSHINE CANYON LANDFILL  
PERIMETER LANDFILL GAS MONITORING PROBES  
DISTANCE-ELEVATION  
NORTH RIDGE

